

**I CLAIM:**

- 1 1. A system for automatic and seamless vertical roaming (SVR) between a wireless local  
2 area network (WLAN) and a wireless wide area network (WWAN) while maintaining an  
3 active voice or data communication:
  - 4 (a) a mobile station for WWAN and WLAN transmissions to the WLAN and the  
5 WWAN network;
  - 6 (b) a WLAN gateway linked to the mobile station by a WLAN bi-directional  
7 communication link and operating in the Global System Mobile (GSM)/General  
8 Packet Radio Service (GPRS) or IEEE 802.11 modes;
  - 9 (c) a base transceiver station operating in the GSM GPRS modes for servicing the  
10 WWAN and linked to the mobile station by a WWAN bi-directional  
11 communication link;
  - 12 (d) a switched network including a mobile switching center connected to the WLAN  
13 gateway and the base transceiver station; and
  - 14 (f) WLAN command apparatus to initiate transfer of traffic between the mobile  
15 station and a remote user on the WLAN via the gateway to the WWAN when  
16 signal degradation occurs.

1 2. The system of Claim 1 further comprising:  
2 (g) WWAN command apparatus to initiate transfer of traffic between the mobile  
3 station and a remote user via the WWAN to the gateway to the WLAN when the  
4 mobile station enters the WLAN area.

1 3. The system of Claim 1 further comprising:  
2 (h) a dual mode radio for SVR switching between the WWAN and the WLAN and  
3 vice versa as a user travels between the networks.

4 4. The system of Claim 1 further comprising:  
(i) a mobile switching center providing an Explicit Call Transfer (ECT) function for  
SVR switching between WLAN/WWAN networks.

5 5. The system of Claim 1 further comprising:  
(j) WLAN signaling apparatus for interleaving WLAN signaling in vacant  
GSM/GPRS traffic slots.

1 6. The system of Claim 1 further comprising:  
2 (k) traffic apparatus for interleaving WLAN/WWAN voice/data traffic in vacant  
3 GSM/GPRS signaling slots.

1 7. The system of Claim 1 further comprising:  
2 (l) An SVR interface linking a dual mode radio API with a GSM/GPRS protocol stack  
3 and a WLAN IEEE 802.11 protocol stack.

1 8. The system of Claim 7 wherein the SVR interface further comprises a three-layer  
2 communication interface.

1 9. The system of Claim 1 further comprising:  
2 a jitter buffer in the WLAN to transform random packet arrival times into uniformly  
3 spaced streaming data.

1 10. The system of Claim 1 further comprising:  
2 circuit switching apparatus between the WWAN and the WLAN for maintaining a  
3 connection between parties on the WWAN and the WLAN when transferring from WWAN to  
4 the WLAN and vice versa.

1 11. A method for automatic and seamless vertical roaming between a wireless local area  
2 network (WLAN) and a wireless wide area network (WWAN) while maintaining an active voice  
3 or data connection comprising the Steps of:

4 (a) issuing a command to the WWAN by a mobile station including a dual  
5 mode Radio capable of WWAN and WLAN transmission, the command  
6 initiating transfer of a voice or data call on the WWAN to a remote party  
7 on the WLAN;

- 8 (b) checking whether or not a gateway is linked to the dual mode Radio for  
9 WLAN transmissions while maintaining the call between the remote party  
10 and the mobile station;
- 11 (c) verifying by the dual mode Radio that the caller identification is from a  
12 WWAN transmission and signaling the WLAN gateway to accept the call;
- 13 (d) storing the packets at the mobile station while waiting for the  
14 establishment of a WLAN connection;
- 15 (e) dropping the WWAN transmission for the call by the WWAN network;  
16 and
- 17 (f) connecting the caller via the gateway and releasing the stored packets to  
18 the dual mode Radio for WLAN transmission.

1 12. A method for automatic and seamless vertical roaming between a wireless local area  
2 network (WLAN) and a wireless wide area network (WWAN) while maintaining an active voice  
3 or data connection comprising the steps of:

- 4 (a) issuing a command to the gateway by a mobile station including a dual  
5 mode Radio capable of WWAN and WLAN transmission, the command  
6 initiating transfer of a VoIP call or data communications on the WLAN to  
7 a remote party on the WWAN;
- 8 (b) checking by the WWAN network whether or not the dual mode Radio for  
9 WWAN transmissions is registered to the WWAN network while  
10 maintaining the call between the remote party and the mobile station;

- 11 (c) verifying by the dual mode Radio that the caller identification is from a  
12 WLAN transmission and signaling the WWAN network to accept the call;  
13 (d) storing the packets at the mobile station while waiting for the  
14 establishment of the WWAN connection;  
15 (e) dropping the WLAN transmission for the call by the WLAN network; and  
16 (f) connecting the caller to the mobile station via the WWAN network and  
17 releasing the stored packets to the dual mode Radio for WWAN  
18 transmissions.

13. The method of Claims 11 and 12 further comprising:

- (g) initiating transfer of traffic between the mobile station and a remote user  
via the WWAN to the WLAN when the mobile station enters the WLAN  
area.

14. The method of Claims 11 and 12 further comprising:

- (h) switching a dual mode radio between the WWAN and the WLAN and vice  
versa as a user travels between the networks.

1 15. The method of Claims 11 and 12 further comprising:  
2 (i) providing an Explicit Call Transfer (ECT) function for SVR switching  
3 between WLAN/WWAN networks when a user roams in the networks.

1 16. The method of Claims 11 and 12 further comprising:  
2 (j) interleaving WLAN signaling in vacant GSM/GPRS traffic slots.

1 17. The method of Claims 11 and 12 further comprising:  
2 (k) interleaving WLAN/WWAN voice/data traffic in vacant GSM/GPRS  
3 signaling slots.

1 18. The method of Claims 11 and 12 further comprising:  
2 (l) linking a dual mode radio API with a GSM/GPRS protocol stack and a  
3 WLAN IEEE 802.11 protocol stack for SVR between WWAN and  
4 WLAN and vice versa.

1 19. The method of Claim 18 wherein the SVR interface further comprises a three-layer  
2 communication interface.

1 20. The method of Claims 11 and 12 further comprising:  
2 transform random packet arrival times into uniformly spaced streaming data using a jitter  
3 buffer.

1 21. The method of Claims 11 and 12 further comprising:  
2 maintaining a connection between parties on the WWAN and the WLAN when  
3 transferring from WWAN to the WLAN and vice versa.

1 23. A medium, executable in a computer system for automatic and seamless vertical roaming  
2 between a wireless local area network (WLAN) and a wireless wide area network (WWAN)  
3 while maintaining an active voice or data connection comprising:

- 4 (a) program instructions issuing a command to the WWAN by a mobile  
5 station including a dual mode Radio capable of WWAN and WLAN  
6 transmission, the command initiating transfer of a voice or data call on the  
7 WWAN to a remote party on the WLAN;  
8  
9 (b) program instructions checking whether or not a gateway is linked to the  
10 dual mode Radio for WLAN transmissions while maintaining the call  
11 between the remote party and the mobile station;  
12  
13 (c) program instructions verifying by the dual mode Radio that the caller  
14 identification is from a WWAN transmission and signaling the WLAN  
15 gateway to accept the call;  
16  
17 (d) program instructions storing the packets at the mobile station while  
18 waiting for the establishment of a WLAN connection;  
19  
20 (e) program instructions dropping the WWAN transmission for the call by the  
21 WWAN network; and  
22  
23 (f) program instructions connecting the caller via the gateway and releasing  
24 the stored packets. to the dual mode Radio for WLAN transmission.

- 1 24. A medium, executable in a computer system for automatic and seamless vertical roaming  
2 between a wireless local area network (WLAN) and a wireless wide area network (WWAN)  
3 while maintaining an active voice or data connection comprising:
- 4 (a) program instructions issuing a command to the gateway by a mobile station  
5 including a dual mode Radio capable of WWAN and WLAN transmission, the  
6 command initiating transfer of a VoIP call or data communications on the WLAN  
7 to a remote party on the WWAN;
  - 8 (b) program instructions checking by the WWAN network whether or not the dual  
9 mode Radio for WWAN transmissions is registered to the WWAN network while  
10 maintaining the call between the remote party and the mobile station;
  - 11 (c) program instructions verifying by the dual mode Radio that the caller  
12 identification is from a WLAN transmission and signaling the WWAN network to  
13 accept the call;
  - 14 (d) program instructions storing the packets at the mobile station while waiting for  
15 the establishment of the WWAN connection;
  - 16 (e) program instructions dropping the WLAN transmission for the call by the WLAN  
17 network; and
  - 18 (f) program instructions connecting the caller to the mobile station via the WWAN  
19 network and releasing the stored packets to the dual mode Radio for WWAN  
20 transmissions.